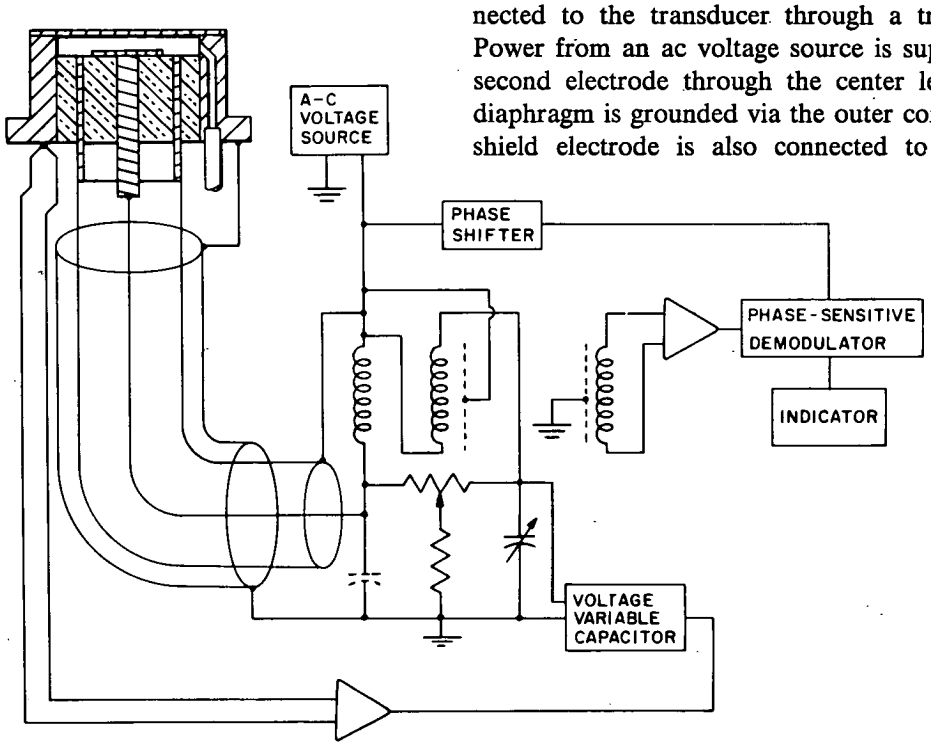
February 1975 B75-10025

NASA TECH BRIEF

Ames Research Center

Trielectrode Capacitive Pressure Transducer

A capacitive transducer has been devised to eliminate adverse effects of temperature and humidity; it is especially suited for measuring pressure changes in a high-temperature environment. As indicated in the diagram, the transducer basically is a three-electrode device; a housing supports on its upper rim a flexible diaphragm which is one of a pair of capacitor electrodes, the second electrode being a metal plate or thin metal film supported within the housing on an insulator block so that it is parallel to the diaphragm at a predetermined distance. A cylindrical shield electrode divides the insulator block into two parts. Changes in the pressure applied to the external side of the diaphragm changes the spacing between it and the second electrode and provides a change in electrical capacitance which is relatable to the magnitude of the pressure applied to the diaphragm.



The circuitry for applying potential between electrodes and measuring capacitance changes is connected to the transducer through a triaxial cable. Power from an ac voltage source is supplied to the second electrode through the center lead, and the diaphragm is grounded via the outer conductor. The shield electrode is also connected to the voltage source so that its potential is of the same amplitude and phase as that applied to the second electrode.

The measuring circuit is, in effect, a current-nulling bridge, which includes a transformer with a pair of bifilar primaries connected in opposition. The two windings are connected serially between the capacitive electrodes and to the reference capacitance. Because potential from the voltage source is applied to the diaphragm and to the reference capacitance through

(continued overleaf)

the windings, a change in capacitance will cause a corresponding change in relative current flow in the pair of windings and, hence, a change in the output potential of the transformer secondary winding. The change in ouput potential is proportional to any change in the relative current flow through the primary windings and, therefore, to any change in capacitance between the capacitive electrodes. The resistive current component, which is affected by increase in temperature, is in quadrature with the capacitive current component; however, the phase-sensitive demodulator, controlled by the voltage source through the phase shifter, separates and eliminates any resistive component in the output of the secondary winding from the desired capacitive component which is to be detected by the indicator.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B75-10025

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel
Mail Code 200-11A
Ames Research Center
Moffett Field, California 94035

Source: Grant W. Coon
Ames Research Center
(ARC-10711)